REMARKS

Summary of the Examiner's rejections

The Examiner, as understood, objected to the amendment made to Claim 1 in the Applicants Amendment mailed 5/30/02 under 35 USC § 132 based on a view that "unimpeded" is not supported by the original disclosure. Claims 1-12 and 16-19 were rejected under 35 USC § 103 (a) as being unpatentable over Fox III et al. (US Patent No. 5,128,831) in view of Brown et al. (US Patent No. 4,823,233). Claims 13-15 and 20 were rejected under 35 USC § 103(a) as being unpatentable over Fox et al. and Brown et al. in combination with Kato (US Patent No. 5,051,865).

Reasons Rejections are Believed to have been Overcome

The amendment made to Claim 1 in the Applicants' Amendment mailed 5/31/02, as understood, was objected to by the Examiner under 35 USC § 132 based on a view that the added term "unimpeded" was not supported by the original disclosure. In response, Applicants request entry of currently amended Claim 1 which eliminates the term "unimpeded." However, by this Amendment, Applicants do not impliedly agree that the subject matter of "impeded" is not supported by the original disclosure, rather as discussed in the prior Amendment mailed on 5/31/02 Applicants maintain that the subject matter of "unimpeded" is within the original disclosure. Applicants respectfully submit that the objection to Claim 1 under 35 USC § 132 has been overcome by the elimination of the term "unimpeded."

Claim 1, as understood, was rejected under 35 USC § 103(a) based on a view that combining the flow channels disclosed in Brown et al. with the rings of the chip stack

disclosed in Fox III et al. would have been obvious to one of ordinary skill in the art. In response, Applicants respectfully submit that the disclosure of Fox et al. teaches away from combining the flow channels disclosed in Brown et al. with the rings of the chip stack disclosed in Fox et al.

In support thereof, the uniformity of the amount of expansion and contraction of the materials that make up the chip stack of Fox III et al. appears to be emphasized therein. For example, as understood, the disclosure of Fox III et al. states a preference to fabricate the die package with the same material as the material that the carrier is fabricated to reduce reliability problems caused by incompatible thermal expansion coefficients between the die package and the carrier.[1] Additionally, the disclosure of Fox III et al. suggests that the carrier may be fabricated from the same material as the ring to reduce the reliability problems related to differences in thermal expansion coefficients of the various materials. These two instances discuss the preference to fabricate the die package, carrier and ring with the same material. In this way, as understood, the die package, carrier and ring will have the same thermal coefficient of expansion and as a result will uniformly expand and contract at the same rate. As understood, Applicants believe that the uniform expansion and contraction between the 1) die package and carrier interconnection and 2) carrier and ring interconnection are preferred so as to reduce the stresses created at these interconnections.

In this same line of thought, if the flow channels of Brown et al. were combined with the rings of the chip stack of Fox III et al., then the combination would increase the stresses at the carrier and ring intersection by creating, as understood, a non-uniform amount of expansion and contraction between the carrier and ring. In support thereof, the

[1] Fox et al., col. 4, lns. 41-47.

following equation "$\Delta L=\alpha L_0(T_2-T_1)$" determines the expansion and contraction in a material. In this equation, L is length, α is coefficient of linear thermal expansion and T is temperature.[2] As shown, the amount of expansion and contraction of a material is a function of 1) coefficient of thermal expansion and 2) temperature. As such, both the coefficient of thermal expansion as well as the temperature of the carrier and ring material needs to be controlled to have a uniform expansion and contraction thereof. In this regard, as understood, the flow channels would cool the temperature of the ring faster than the carrier based on a view that the heat creating chip is attached on the carrier and not the ring. Previously, when the flow channels are not formed in the ring, then the upper carrier, lower carrier and ring form an enclosed oven to heat the carriers and ring evenly, as understood. As such, the amount of expansion and contraction of the ring and carrier will be non-uniform when flow channels are combined with the rings of the chip stack disclosed in Fox III et al. Hence, Applicants respectfully submit that the disclosure of Fox III et al. teaches away from combining the flow channels disclosed in Brown et al. to the chip stack disclosed in Fox III et al.

Additionally, Applicants respectfully submit that the disclosure of Fox III et al. contains no suggestion or motivation for forming flow channels in the ring based on a view that cyclical thermal expansion and contraction would make the invention disclosed in Fox III et al. inoperable for its intended purpose.[3]

As understood, the intended purpose of Fox III et al. is to form a chip stack with at least two chips stacked upon one another and electrically connected to one another.[4] The electrical connection between the stacked chips are made by filling molten solder

[2] Michael R. Lindeburg, P.E., Engineer in Training Manual, Sixth Ed., Professional Publications, Inc. 1982.
[3] MPEP § 2143.01.
[4] Fox III et al., col. 2, lns. 53-57.

through the carrier and ring through-holes under vacuum and subsequently solidifying the solder.[5] In other words, the solder is an individual solid piece which runs vertically through all respective ring and carrier through-holes.

If flow channels are formed in the rings of the chip stack disclosed in Fox III et al., then the amounts of expansion and contraction between the ring and carrier will be different, as discussed above. This difference creates, as understood, stresses within the solidified solder at the carrier and ring interconnection. As understood, as the chip stack heats and cools, cyclical stresses at the carrier and ring interconnection will eventually break the solidified solder thereby breaking the electrical connection between chips within the chip stack. As such, the addition of flow channels may render the invention disclosed in Fox III et al. inoperable for its intended purpose. Hence, Applicants' respectfully submit that Claim 1 is allowable.

By way of example and not limitation, the dependent claims of Claim 1 are believed to contain additional patentable subject matter such as amended Claim 16 in that the "flow channels are defined between each adjacent pair of castellations." Applicants' respectfully submit that Brown et al. is not 35 USC § 102 prior art based on a view that Brown et al. does not disclose castellations. A castellation is formed by eliminating ring material from the top surface of the ring to a point within the ring, as shown in Fig. 3 of the original disclosure. Additionally, castellated is defined as "furnished with turrets and battlements in the style of a castle" wherein battlements is defined as "a parapet built on top of a wall, with indentations for defense or decoration."[6] In contrast, a perforation is

[5] Fox III et al., col. 5, lns. 35-45.
[6] The American Heritage Dictionary, Second College Edition, s.v. "castellated" and "battlement".

formed by eliminating ring material through the ring thereby the ring top surface remains in the same plane, as shown in Fig. 1 of Brown et al.

Even if the disclosure of Brown et al. disclosed castellations, there would be no motivation to combine castellations with the rings of the chip stack disclosed in Fox III et al. based on a view that (1) Fox III et al. teaches away from combining castellations with the rings of the chip stack disclosed therein, and (2) combining castellations with the rings of the chip stack disclosed in Fox III et al. would render the invention disclosed therein inoperable for its intended purpose, as discussed above in relation to flow channels.

Additionally, Claim 18 is believed to contain additional patentable subject matter. In particular, Claim 18 claims flow channels that extend from the top surface of the thermal ring. The disclosure of Brown et al. does not disclose flow channels that extend from the top surface of the thermal ring, rather the disclosure of Brown et al. discloses flow channels that extend from below the top surface of the thermal ring. Hence, Applicants respectfully submit that the dependent claims of Claim 1 , namely, Claims 2-20 are believed to be allowable.

CONCLUSION

On the basis of the foregoing, Applicants respectfully submit that Claims 1-20 are in condition for allowance. Applicants therefore respectfully submit that all the stated grounds of rejection have been overcome. Accordingly, an early Notice of Allowance is respectfully requested. Should the Examiner have any suggestions for expediting

allowance of the application, the Examiner is invited to contact Applicant's representative at the number listed below.

Respectfully submitted,

Date: 4/3/03 By: _____

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